Remarks/Arguments:

Claims 1-4, 6-11, 14-27 are currently pending. Claim 28 has been canceled without prejudice or disclaimer. Claims 1, 11, 21, and 22 have been amended with subject matter found in the original disclosure, such as the first paragraph of the detailed description, page 6, line 27, through page 7, line 14, page 12, lines 23-27, figure 3, and/or claim 28. Claims 14-17, 19, 20, 23, and 26 have been amended for clarification. It is respectfully submitted that no new matter has been entered.

The Patent Office rejected claims 1-4, 6-10, and 25 under 35 U.S.C. 112, second paragraph, as being indefinite.

With the amendment of "wherein M, M_1, M_2, N, N_1 and N_2 are all non-zero integers except one of N_1 and N_2 may be zero" to "wherein M, M_1, M_2, N, N_1 and N_2 are all integers," Applicant respectfully submits that claims 1-4, 6-10, and 25 are definite and clear and respectfully requests that the Patent Office withdraw its rejections under 35 U.S.C. 112, second paragraph.

The Patent Office rejected claims 1-4, 7, 9, 10, 21, 25, and 27 as being unpatentable over Hottinen, WO 02/47286, in view of Kim, U.S. Published Patent Application No. 2003/0128769 ("Kim I").

Without admitting either an implicit need or explicit need to amend the claims, to advance prosecution, Applicant has amended the claims.

There are four independent claims: 1, 11, 21, and 22.

Claim 1 recites as follows:

> A method comprising: **encoding, at an encoder, a plurality of N systematic bits across time and space into an encoded packet of size M bits, wherein encoding the plurality of N systematic bits comprises interleaving the plurality of N systematic bits**; determining a quality of at least a first channel from a feedback circuit; **channel interleaving the plurality of N systematic bits and parity bits corresponding to the N systematic bits**; dividing the encoded packet into a first transmission packet defining a first size M_1 bits that includes N_1 of the N systematic bits and a second transmission packet defining a second size M_2 bits that includes N_2 of the N systematic bits, wherein at least one of M_1 and N_1 is based on the determined quality of the first channel; and transmitting in parallel the first transmission packet from a first antenna at a first rate at a

> first power over the first channel and the second transmission packet from a second antenna at a second rate that differs from the first rate and at the first power modified by a second weight value over a second channel, wherein M, M_1, M_2, N, N_1 and N_2 are all integers, M is greater than N, M is at least equal to M_1+M_2, and N is at least equal to N_1+N_2.

Claim 21 recites as follows:

> A method comprising: encoding a plurality of input bits **across time and space** such that parity bits corresponding to the input bits are interleaved; based on a determined characteristic of at least a first channel, adaptively splitting the encoded input bits into a first subpacket defining a first subpacket size and a second subpacket defining a second subpacket size; and **transmitting the first subpacket at a first rate and at a first power over the first channel and the second subpacket at a second rate that differs from the first rate and at a second power that differs from the first power over a second channel, wherein the first and second powers are determined using Lagrangian maximization with a total power constraint.**

Hottinen discloses a method for controlling the weighting of a data signal in at least two elements of a first radio connection unit of a radio communications system where the data signal is to be distributed for parallel transmission to a second radio connection unit (abstract). Hottinen discloses that the transmitted data elements can be received at the second radio connection unit by one antenna element or by several antenna elements (page 7, lines 5-7). On page 17, lines 14-18, Hottinen discloses "To each beam, there is assigned a data rate with which bits are to be transmitted and an output power. The number of beams to be used, the beam weights, the data rates and the power for the selected beams are determined in the user equipment," and on page 20, lines 17-22, "the data rates R1 to RN in a way that R = R1 + R2 + ... + RN = const. To this end, the signal-to-noise ratio SNR of the selected beams is evaluated. The selected dominant beam with the highest SNR is assigned the highest data rate and the selected dominant beam with the lowest SNR is assigned the lowest data rate." An example, on page 22, of Hottinen, provides that "different encoded bits are transmitted from different beams with the assigned power" and where there is a systematic bit and two parity bits, the systematic bit is transmitted on two beams and each of the parity bits is transmitted on a signal beam.

Hottinen, on page 24, lines 1-9, discloses a plurality M of transmit antennas and a plurality N of receive antennas. Hottinen also discloses feedback information, such as on page 28, lines 15-18.

Hottinen discloses in paragraph 0053 as follows:

> [0053] The data signals to be transmitted by the base station are split in the base station to multiple downlink beams after channel encoding so that different encoded bits are transmitted from different beams with the assigned power. For coding, e.g. **Turbo coding is used** and the bits are sequentially sent via the different beams, taking into account the different assigned data rates R1 to RM. Moreover, **the bits are suitably interleaved across the spatial channels so that even if one channel or beam has a very low SNR, the data can be decoded**. For example, random interleaving, or some optimised interleaving can be used. As an example, with rate 1/3 Turbo encoder that provides systematic bit (x0), parity bit 1 (x1) and parity bit 2 (x2), we can transmit x0 through at least two beams, x1 through beam 1 and x2 through beam 2. Thus, the encoded signal is distributed in at least two beams, with at least partially different contents. Each beam is formed by weighting the supplied encoded data bits in the antenna elements with the corresponding set of weights, which includes weight information for each antenna element for the specific beam. At the terminal, the different parts of the data signals distributed to the different beams are combined again in order to obtain the correct symbol or bit order for channel decoding or for any other following receiver stage.

Hottinen does not clearly disclose, in paragraph 0053 or elsewhere, "**encoding, at an encoder, a plurality of N systematic bits across time and space into an encoded packet of size M bits, wherein encoding the plurality of N systematic bits comprises interleaving the plurality of N systematic bits.**" Furthermore, Hottinen does not disclose this claimed subject matter in combination with further claimed subject matter of "**channel interleaving the plurality of N systematic bits and parity bits corresponding to the N systematic bits.**"

Kim I discloses an apparatus and method for transmitting/ receiving data according to channel conditions. In paragraph 0101, Kim I discloses encoding by a channel encoder in step 142 and channel interleaving two data streams after encoding in steps 146-1 and 146-2. Although Kim I in paragraph 0012 discloses an interleaver internal to the encoder in the prior art, Kim I does not disclose encoding across both time and space. Instead Kim I discloses this internal interleaver as providing two different streams Y1 and Y2 of parity bits.

Like Hottinen, Kim I does not clearly disclose "**encoding, at an encoder, a plurality of N systematic bits across time and space into an encoded packet of size M bits, wherein encoding the plurality of N systematic bits comprises interleaving the plurality of N systematic bits.**" Furthermore, Kim I does not disclose this claimed subject matter in combination with further claimed subject matter of "**channel interleaving the plurality of N systematic bits and parity bits corresponding to the N systematic bits.**"

Hottinen discloses power, including relative power distribution, in paragraphs 0042, 0049-0053, 0057, 0063, and 0066. Hottinen does not disclose or suggest "**transmitting the first subpacket at a first rate and at a first power over the first channel and the second subpacket at a second rate that differs from the first rate and at a second power that differs from the first power over a second channel, wherein the first and second powers are determined using Lagrangian maximization with a total power constraint.**"

Kim I discloses receiving and transmitting data according to channel conditions. In paragraphs 0052 through 0052, Kim I discloses as follows:

> [0052] A detailed description of the first method will now be made. If a coding rate is a symmetric coding rate of [1/2], a channel encoder receives 1 input bit and outputs 2 coded bits. In this case, 1 bit out of the 2 coded bits is a systematic bit and the remaining 1 bit is a parity bit. If the coding rate is an asymmetric coding rate of [3/4], the channel encoder receives 3 input bits and outputs 4 coded bits. The 4 coded bits are comprised of 3 systematic bits and 1 parity bit.
> [0053] As stated above, the present invention is applied to a mobile communication system with multiply transmission antennas, or an antenna array, and the antenna array simultaneously transmits transmission data through several transmission antennas. In addition, the transmission antennas have different transmission conditions according to conditions of their radio channels, since the transmission signals transmitted through the transmission antennas pass through different radio channels. If two transmission antennas are used, the transmission antennas may have a channel pattern [H, L] or its reverse channel pattern. Here, "H" means that a channel condition where the data is transmitted through the transmission antenna is good, so that there is a low probability that an error will occur in the transmission data. This is defined as "good transmission condition" or "high reliability." Further, "L" means that a channel condition where the data is transmitted through the transmission antenna is poor, so that there is a high probability that an error will occur in the transmission data. This is defined as "poor

> transmission condition" or "low reliability." In this case, systematic bits with high priority among the coded bits are assigned (or mapped) to a transmission antenna with a good transmission condition, and parity bits with low priority are assigned to a transmission antenna with a poor transmission condition, thereby increasing system performance. An exemplary method of assigning data bits/symbols to transmission antennas according to a coding rate and a transmission condition of the transmission antennas will be described herein below.
> [0054] It will be assumed that a coding rate is [1/2], and the number of transmission antennas is 4. When 4 transmission antennas are used, a transmission condition pattern of the transmission antennas can be determined as [H, M, M, L], [H, M, L, L], [H, L, L, L], [H, L, x, x] or [1, 2, 3, 4]. In the pattern, "M" means a medium transmission condition, "L" means a low transmission condition (poor reliability), "H" means a high transmission condition (high reliability), and "x" represents a bad transmission condition in which transmission is impossible. In addition, 1, 2, 3, and 4 represent a relative transmission order. No matter whether the transmission conditions are represented by H and L or 1, 2, 3 and 4, two transmission antennas with a good transmission condition transmit systematic bits with high priority, and the remaining two transmission antennas transmit parity bits with low priority. If the transmission condition pattern is [H, x, x, L], the systematic bits are transmitted through transmission antennas with a transmission condition H, and the parity bits are transmitted through transmission antennas with a transmission condition L. In addition, data bits separated according to priority may undergo channel interleaving and modulation in the same way. Alternatively, the data bits may undergo channel interleaving and modulation in different ways, if a receiver previously knows the channel interleaving rule and the modulation scheme.

Kim I discloses power, including power condition information, in paragraphs 0030-0034, 0093, 0097, and 0098. Kim I does not disclose or suggest "**transmitting the first subpacket at a first rate and at a first power over the first channel and the second subpacket at a second rate that differs from the first rate and at a second power that differs from the first power over a second channel, wherein the first and second powers are determined using Lagrangian maximization with a total power constraint**."

Since neither Kim I nor Hottinen disclose or suggest this claimed subject matter, any purported combination of these references will not disclose this claimed subject matter.

Thus, claims 1-4, 7, 9, 10, 21, 25, and 27 are not made obvious by the combination of Hottinen and Kim I.

The Patent Office rejected claim 6 as being unpatentable over Hottinen, WO 02/47286, in view of Kim I, U.S. Published Patent Application No. 2003/0128769, and further in view of Kim, U.S. Patent No. 7,277,407 ("Kim II").

Claim 6 recites as follows: "transmitting the second transmission packet from the second antenna over the second channel at a second power modified by a third weight value, and from the first antenna over the first channel at the second power modified by a fourth weight value."

Kim II does not disclose interleaving.

Since none of Kim I, Hottinen, and Kim II disclose or suggest this claimed subject matter, any purported combination of these references will not disclose this claimed subject matter.

Thus, claims 1-4, 7, 9, 10, 21, 25, and 27 are not made obvious by the combination of Hottinen, Kim I, and Kim II.

The Patent Office rejected claims 8 and 17 as being unpatentable over Hottinen, WO 02/47286, in view of Kim, U.S. Published Patent Application No. 2003/0128769 ("Kim I"), and further in view of Salvi, U.S. Published Patent Application No. 2004/0139383.

Claims 8 and 17 recite, identically or similarly, as follows: "encoding further comprises turbo encoding using a single turbo interleaver of size N prior to interleaving over the M bits."

Salvi discloses a concatenated encoder. In paragraph 0007, discussing prior art, Salvi discloses "the code bits between the coding stages may be interleaved (i.e., reordered) to provide temporal diversity."

Like Hottinen and Kim I, Salvi does not disclose "**encoding, at an encoder, a plurality of N systematic bits across time and space into an encoded packet of size M bits, wherein encoding the plurality of N systematic bits comprises interleaving the plurality of N systematic bits.**" Furthermore, Salvi does not disclose this claimed subject matter in combination with further claimed subject matter of "**channel interleaving the plurality of N systematic bits and parity bits corresponding to the N systematic bits.**"

Because none of Salvi, Kim I, and Hottinen disclose this claimed subject matter, no purported combination of these references would disclose or suggest this claimed subject matter.

Thus, claims 8 and 17 are allowable.

The Patent Office rejected claims 11, 14, 18-20, 24, and 26 as being unpatentable over Kim, U.S. Published Patent Application No. 2003/0128769 ("Kim I"), in view of Hottinen, WO 02/47286, and further in view of Ketchum, U.S. Published Patent Application No. 2003/0048856.

Claim 11 recites as follows:

> A device comprising: **an encoder having an input configured to receive a plurality of N systematic bits and an output configured to output a plurality of M bits, wherein M is greater than N, wherein the encoder is configured to encode the N systematic bits over time and to interleave the N systematic bits over space**; a channel feedback circuit configured to determine a channel characteristic of a first communication channel; a demultiplexer having an input configured to receive an output of the channel feedback circuit, said demultiplexer configured to output in parallel a first portion M_1 of the M bits at a first output and a second portion M_2 of the M bits at a second output; **a channel interleaver disposed between the encoder and the demultiplexer and configured to channel interleave the N systematic bits and parity bits corresponding to the N systematic bits and provide the channel interleaved N systematic bits and parity bits to the demultiplexer**; a first amplifier configured to increase a power of said first portion M_1 of the M bits to a first power prior to transmission from said first antenna; a first antenna configured to transmit, at a first rate, said first portion M_1 of the M bits; a second amplifier configured to increase a power of said second portion M_2 of the M bits to a second power prior to transmission from said second antenna; and a second antenna configured to transmit, at a second rate that differs from the first rate, said second portion M_2 of the M bits; and a first eigenvector block in series with the first output, said first eigenvector block configured to apply a first power weight factor to said first portion M_1 of the M bits prior to transmission from said first antenna and configured to apply a second power weight factor to said first portion M_1 of the M bits prior to transmission from said second antenna.

For the reasons discussed above for claims 1-4, 7, 9-10, 21, 25, and 27, claims 22, 23, and 28 are not made obvious by the combination of Hottinen and Kim I.

Ketchum has been cited by the Patent Office as a teaching for an eigenvector block. Ketchum does not teach "**an encoder having an input configured to receive a plurality of N systematic bits and an output configured to output a plurality of M bits, wherein M is greater than N, wherein the encoder is configured to encode the N systematic bits over time and to interleave the N systematic bits over space.**" Furthermore, Ketchum does not disclose

this claimed subject matter in combination with further claimed subject matter of "**a channel interleaver disposed between the encoder and the demultiplexer and configured to channel interleave the N systematic bits and parity bits corresponding to the N systematic bits and provide the channel interleaved N systematic bits and parity bits to the demultiplexer.**"

Ketchum does not remedy the deficiency of Hottinen and Kim I. As such, no purported combination of Ketchum, Hottinen, and Kim I would make obvious the claimed invention.

Thus, claims 11, 14, 18-20, 24, and 26 are allowable.

The Patent Office rejected claims 15 and 16 as being unpatentable over Kim, U.S. Published Patent Application No. 2003/0128769 ("Kim I"), in view of Hottinen, WO 02/47286, and further in view of Ketchum, U.S. Published Patent Application No. 2003/0048856, and further in view of Kim, U.S. Patent No. 7,277,407 ("Kim II").

Kim II has been cited to teach "transmission at a second power modified by a third weight value at a given antenna, and from another antenna at the second power modified by a fourth weight value.

Like Kim I, Hottinen, and Ketchum, Kim II does not teach "**an encoder having an input configured to receive a plurality of N systematic bits and an output configured to output a plurality of M bits, wherein M is greater than N, wherein the encoder is configured to encode the N systematic bits over time and to interleave the N systematic bits over space.**" Furthermore, Kim II does not disclose this claimed subject matter in combination with further claimed subject matter of "**a channel interleaver disposed between the encoder and the demultiplexer and configured to channel interleave the N systematic bits and parity bits corresponding to the N systematic bits and provide the channel interleaved N systematic bits and parity bits to the demultiplexer.**"

Kim II does not remedy the deficiency of Hottinen, Kim I, and Ketchum. As such, no purported combination of Ketchum, Hottinen, Kim I, and Kim II would make obvious the claimed invention.

Thus, claims 15 and 16 are allowable.

The Patent Office rejected claim 17 as being unpatentable over Kim, U.S. Published Patent Application No. 2003/0128769 ("Kim I"), in view of Hottinen, WO 02/47286, and further

in view of Ketchum, U.S. Published Patent Application No. 2003/0048856, and further in view of Salvi, U.S. Published Patent Application No. 2004/0139383.

Claim 17 recites as follows: "wherein said encoder comprises an interleaver of length N, the transmitter further comprising a channel interleaver of length M configured to receive the output of the encoder."

As discussed above, Kim I, Hottinen, Ketchum, and Salvi do not teach "**an encoder having an input configured to receive a plurality of N systematic bits and an output configured to output a plurality of M bits, wherein M is greater than N, wherein the encoder is configured to encode the N systematic bits over time and to interleave the N systematic bits over space.**" Furthermore, Salvi does not disclose this claimed subject matter in combination with further claimed subject matter of "**a channel interleaver disposed between the encoder and the demultiplexer and configured to channel interleave the N systematic bits and parity bits corresponding to the N systematic bits and provide the channel interleaved N systematic bits and parity bits to the demultiplexer.**"

Salvi does not remedy the deficiency of Hottinen, Kim I, and Ketchum. As such, no purported combination of Ketchum, Hottinen, Kim I, and Salvi would make obvious the claimed invention.

Thus, claim 17 is allowable.

The Patent Office rejected claims 22, 23, and 28 as being unpatentable over Hottinen, WO 02/47286, in view of Kim, U.S. Published Patent Application No. 2003/0128769 ("Kim I").

Claim 22 recites as follows:

> An apparatus comprising: **an encoder configured to encode a plurality of input bits over time and to interleave the input bits over space**; a demultiplexer configured to adaptively split the encoded plurality of bits into a first subpacket defining a first subpacket size and a second subpacket defining a second subpacket size; a channel interleaver disposed between the encoder and the demultiplexer and configured to channel interleave the plurality of input bits and parity bits corresponding to the plurality of input bits; a first antenna configured to transmit the first subpacket at a first rate and at a first power over a first channel; and a second antenna configured to transmit the second subpacket at a second rate that differs from the first rate and at a second power that differs from the first power over a second channel, **wherein the first and second**

powers are determined using Lagrangian maximization with a total power constraint.

For the reasons discussed above for claims 1-4, 7, 9-10, 21, 25, and 27, claims 22, 23, and 28 are not made obvious by the combination of Hottinen and Kim I.

The Patent Office is respectfully requested to reconsider and remove the rejections of the claims under 35 U.S.C. 103(a) based on Hottinen and/or Kim I, alone or in combination with Kim II, Ketchum, and/ or Salvi, and to allow all of the pending claims 1-4, 6-11, and 14-27 as now presented for examination. An early notification of the allowability of claims 1-4, 6-11, and 14-27 is earnestly solicited.

Respectfully submitted:

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